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Patent Application

of

MICHAEL KOCH

for

LOAD-RECEIVING DEVICE

Field of the Present Invention

The present invention relates to a load receiving device, especially a slinging point for handling movable components, for example, tower segments of a wind power plant. A load carrying plate extends in the longitudinal axis and, along its two opposing longitudinal sides, has penetration points for passage of at least one fastening means for fixing the load carrying plate on the movable component. A bracket-shaped lifting means is designed for engagement with a hoist, can be swiveled back and forth about a first axis (swiveling axis) and about a second axis (axis of rotation) extending transversely to it, and is pivoted relative to the load carrying plate by a rotary part connected to the load carrying plate.

Background of the Invention

Load suspension devices are commercially readily available in a plurality of embodiments. In the known designs, the pivoting holding bracket, which is connected to the rotary part, as a lifting means for a hoist, such as a load shackle, crane hook or the like, sits on the front of the load carrying plate, and consequently in the center on one of its two opposite longitudinal sides of the carrying plate which is otherwise made more or less cuboidal. With the known approach, the holding bracket can swivel back and forth about its swiveling axis through an angle of 180° and around the axis of rotation of the rotary part through an angle of 360°. In spite of these movement possibilities and degrees of freedom for the holding bracket, collisions of the holding bracket with parts of the load to be moved take place especially when heavy loads are moved, as occur particularly in the handling of tower segments for erecting wind power

plants. On the one hand, this occurrence is accompanied by damage to the load itself, or damaging bending forces are induced at least in the area of the swiveling axis of the holding bracket due to the collisions.

To solve this problem, to some extent the installation crews of wind power plants have already moved to using load suspension devices which they have fabricated themselves, for example, in the form of carrying plates screwed to the end of the respective tower segment and welded-on brackets to facilitate handling, especially erection of tower segments on site. These approaches also, when turning from the vertical to the horizontal and during installation, often cause damage to the components transported in the form of a tower segment, which damage can entail major repair efforts. Furthermore, for the installation crews it is often very time consuming to attach their own special contrivances on site to the respective tower segment before its erection and to remove it again.

DE 201 21 121 U1 discloses an attachment device for attachment of slinging or lashing means to the items to be transported or lashed, with a fastening element formed by a screw and used for its fastening to the respective article, with an attachment element for the slinging or lashing means and with a connecting element connecting the fastening element to the attachment element. The attachment element is pivoted around the longitudinal axis of the fastening element on a two-part sleeve which encloses the fastening element over part of its length. The connecting element has an axial position on the sleeve secured by annular flanges located on opposing ends of the cylindrical sleeve. The connecting element, in the area of the annular flanges of the sleeve, is supported on the sleeve by one row of roller elements respectively. In the known approach, the annular lifting means which forms the attachment element in all its swivel positions is located outside the sleeve. When penetrated by a screw means, the sleeve is used to fix the attachment device on the slinging and lashing means. Installation problems can occur when using this known attachment device in the area of the handling of tower segments.

Summary of the Invention

An object of the present invention is to provide a load suspension device which does not have the disadvantages of the prior art and which may be mounted and removed again especially in very rapid succession on the component to be handled.

Another object of the present invention is to provide a load suspension device able to move and position the component to be handled, for example, a tower segment, such that damage to the component itself is reliably avoided.

These objects are basically attained by a load suspension device comprising a rotary part located on the transverse side of the load carrying plate. Also, in the swivel position of the lifting means, the latter extends within an imaginary extension of the two longitudinal sides of the load carrying plate. A holding bracket with its rotary part is displaced from the area of the longitudinal side to the area of the transverse side of the more or less cuboidal load carrying plate. Potential collision sites between the holding bracket as the lifting means, the hoist which itself acts on the lifting means, and the load which is to be moved are reliably avoided. This collision avoidance is also promoted by the geometrical size configuration that in one swiveling position of the lifting means, the lifting means extends within an imaginary extension of the two longitudinal sides of the load carrying plate. Consequently collision potential between the lifting means and the load carrying plate itself, even under load, is reliably avoided.

In one preferred embodiment of the load suspension device of the present invention, the load carrying plate in the edge area has penetration points. Two fixing screws are used as the fastening means. Their screw heads may be accommodated in depressions of the load carrying plate. With this configuration, a plurality of variously dimensioned tower segments can be handled with their end flanges, on the threaded holes of which the load carrying plate is fixed by fixing screws. Provision is preferably made so that the screw heads of the fixing screws are

secured against unintentional loosening by two covering parts which can be securely joined to the parts of the load carrying plate. This greatly increases the safety of installation.

Other objects, advantages and salient features of the present invention will become apparent from the following detailed description, which, taken in conjunction with the annexed drawings, discloses a preferred embodiment of the present invention.

Brief Description of the Drawings

Referring to the drawings which form a part of this disclosure:

FIG. 1 is a front elevational view of a load suspension device according to an embodiment of the present invention;

FIG. 2 is a side elevational view of the load suspension device of FIG. 1; and

FIG. 3 is a side elevational view in partial section of the load suspension device of FIG. 1 fixed on the end of a tower segment of a wind power plant.

Detailed Description of the Invention

FIG. 1 shows a load suspension device according to an embodiment of the present invention, especially in the manner of a slinging point 10 for handling of movable components, for example, tower segments 12 (shown partially in FIG. 3) of a wind power plant (not shown). The load suspension device has a load carrying plate 16 which extends along the longitudinal axis 14. The load carrying plate 16 is made more or less cuboidal or in the shape of a rectangular parallelepiped, and has two opposing longitudinal sides 18, 20 extending along longitudinal axis 14. The two longitudinal sides 18, 20 are bordered by four transverse sides 22, 24, 26, and 28 of the load carrying plate 16. In the end area of the respective longitudinal side 18, 20 of the load carrying plate 16, penetration points 30 are provided in the form of conventional holes for

passage or receiving of each fastening means 32 in the form of a conventional hexagonal bolt. These hexagonal bolts as the fastening means 32 are used to fix the load carrying plate 16 on the component which is to be moved and handled, for example, in the form of the tower segment 12 (compare FIG. 3).

Furthermore, the load carrying plate 16 has a bracket-shaped lifting means 34 as the holding bracket for engaging the hoist of a load lifting crane (not detailed), for example, in the form of a mobile crane or the like. The relevant hoist can be formed from a crane hook, but also from a load shackle connected to the load gear of the crane and then fitting into the holding bracket as the lifting means 34. The pertinent slinging and moving of loads are conventional, so that they will not be detailed here. The holding bracket, as the lifting means 34, can be swiveled back and forth about a first axis (swiveling axis) 36 and, about a second axis (axis of rotation) 38 extending transversely to the first axis 36. It is pivoted relative to the load carrying plate 16 by a rotary part 40. As illustrated in FIG. 1, in the illustrated swivel position of the holding bracket, the swiveling axis 36 extends parallel to the longitudinal axis 14 of the load carrying plate 16 and the rotation axis 38 of rotation extends vertically relative to the swiveling axis 36. The pertinent imaginary connecting point 42 of axes 36 and 38 is located outside the load carrying plate and above its transverse side 22. Due to the swiveling axis 36, the bracket-shaped lifting means 34 can be swiveled back and forth more or less through an angle of 180°. The lifting means 34 can be turned through an angle of 360° around the vertical axis or the axis of rotation 38. The pertinent rotary adjustment motion can be undertaken optionally in one direction for lack of a stop.

The rotary part 40 is securely connected to the load carrying plate 16 by a screw connection 44 at least partially penetrating more or less in the center of the load carrying plate 16 and extending from the top of the transverse side 22. In the area of the free end of the screw bolt 46, there is a pivoted rotary sleeve 48 of rotary part 40. Two axle pieces extend along the swiveling axis 36 of the lifting means 34, fit the end sides of the rotary sleeve 48 and penetrate

the two free ends of the bracket-like lifting means 34. As shown particularly in the side view in FIG. 2, the outside circumference of the rotary sleeve 48 extends slightly over the two longitudinal sides 18 and 20 of the load carrying plate 16. In the swivel position of the bracket-shaped lifting means 34, which is upright in FIG. 2, it extends within an imaginary extension 52 of the two longitudinal sides 18, 20 of the load carrying plate 16. Consequently, the possible swiveling motion of the holding bracket 34 around its swiveling axis 36 is limited by the upper transverse side 22 of the load carrying plate 16. Thus, in two axial directions which are perpendicular to one another (swiveling axis 36 and axis of rotation 38) it is possible to freely swivel the bracket-shaped lifting means 34 without collisions occurring with the load carrying plate 16 which can be fixed on the tower segment or with the tower segment 12 itself.

The relevant relationships are shown by example in FIG. 3. The tower segment 12, in the form of a conically extending hollow segment, on the inside of its one free end has a flange part 54 with a transverse hole 56 through which the respective fastening means 32, in the form of a hexagonal, bolt can fit. The free end of the hexagonal bolt can then be fixed by a lock nut 58 with a washer 60 on the flange part 54. In the fixed position shown in FIG. 3, the load carrying plate 16 with its one longitudinal side 18 evenly adjoins the lower free end of the flange part 54. As shown particularly in FIG. 3, the bracket-like lifting means 34 can be freely swiveled around the swiveling axis 36. Even in a completely vertical or horizontal arrangement of the tower segment 12 with its outside circumference, no collisions occur in this respect, even when a corresponding hoist, for example, in the form of a crane hook, the load shackle of load gear or the like, are to act on the lifting means 34. Furthermore, the capacity of rotation around the axis of rotation 38 is preserved for the lifting means 34 so that in this respect oblique equalization is possible.

The flange part 54 of the tower segment 12 is made in the manner of a flange ring and has a plurality of fixing possibilities in the form of transverse holes 56 at a definable radial distance from one another. The pertinent geometry can be standardized so that with a small set

of load carrying plates 16 with two fastening means 32 with different spacing all important transport and handling processes can be managed. In this respect, the load suspension device can be designed in the manner of a kit so that with only one component kit all forthcoming transport and handling processes can be managed on site.

As also shown particularly in FIGS. 2 and 3, the load carrying plate 16, in the edge area, is provided with two groove-like depressions 62 in which the screw heads 64 of the fastening means 32 can be accommodated. These recesses 62 can in turn be covered by two cover parts 66 which, fixed by screws 68 on the load carrying plate 16, provide for the screw heads not being able to move unintentionally. In this way, for the safety-relevant screw connection between the load carrying plate 16 and the flange part 52 is not able to loosen.

Two load suspension devices on the lower end of each tower segment are sufficient to be able to move it reliably, especially to remove the tower segment from the transporter and to set it up at the site of the wind power plant. Since the load application point of the hoist by the bracket-like lifting means 34 acts far outside the connecting point 42 of the swiveling axis 36 and the axis of rotation 38 (compare FIG. 1), reliable transport is achieved without damage occurring on the tower segment or damaging forces for the actual load suspension device being induced.

While an embodiment has been chosen to illustrate the invention, it will be understood by those skilled in the art that various changes and modifications can be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is: